East West University

Department of Electronics and Communication Engineering

INTERNSHIP REPORT ON

Operation and Management (NOC) of Worldtel Bangladesh Limited

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Acceptance of Report (Instructor)

This internship report presented to the department of Electronics and Communication Engineering, East West University as a partial fulfillment of the course ETE 498 (Industrial Training) as well as for the Bachelor of Science Degree in Electronics and Telecommunications Engineering (ETE).

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Dean & Professor

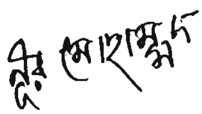
Electronics and Communications Engineering

ACKNOWLEDGEMENT

Preparing a term paper is a difficult task. We faced many problems when we started the work on the report but we are greatly thankful to Almighty Allah for enabling me to get successfully through our responsibilities.

Very warm and special thanks to respected supervisor Dr. M. Mofazzal Hossain, Dean & Professor, Electronics and Communications Engineering who was my academic supervisor for the course ETE 498. He allocated his valuable time throughtout the internship period to guide me for successful completion of the internship and preparing this report.

Last but not the least; I would like to give thanks especially to the company associates and friends, for their enthusiastic encouragements and helps during the preparation of this term paper by sharing ideas regarding this subject and for their assistance in typing and proof reading this manuscript.



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CHAPTER 1

Introduction:

GSM is the most popular method that uses all over the world for mobile communication. Before going into the details of the GSM System it is worthy to have some understanding about the history of GSM.

Company Profile:

WorldTel Limited was established in January 1995 as part of an International Telecommunications Union initiative to help mobilize development of the telecommunications sector in developing countries. The primary catalyst for its creation was a McKinsey & Co. report recommending creation of a separate company for this purpose. Sam Pitroda, who developed the telecommunications services in India, became its first chairman in May 1995. In 1996, $10 million of financing was announced, along with plans for 50 million telephone lines. WorldTel UK was awarded a 2001 license for services in Bangladesh. In 2004 Swedtel, based in Stockholm, was purchased by WorldTel UK Limited

GSM History:

- In 1982-85 Conference Europeans Posts at Telecommunications (CEPT) began specifying a European digital telecommunications standard in the 900 MHz frequency band. This standard later became known as Global System for Mobile communication (GSM).
- In 1986 field tests were held in Paris to select which digital transmission technology to use. The choice was Time Division Multiple Access (TDMA) or Frequency Division Multiple Access (FDMA).

- In 1987 a combination of TDMA and FDMA was selected as the transmission technology for GSM.
- In 1989 European Telecommunication Standards Institute (ETSI) took over responsibility for GSM specification.
- In 1991 the GSM 1800 standard was released.
- In 1992 first commercial Phase 1 GSM networks were launched.

GSM Architecture:

The Base Station Subsystem of a GSM network contains the Base Transceiver Station (BTS), the Base Station Controller (BSC), and the Transponder Controller (TRC). A figure of GSM network components is given bellow.

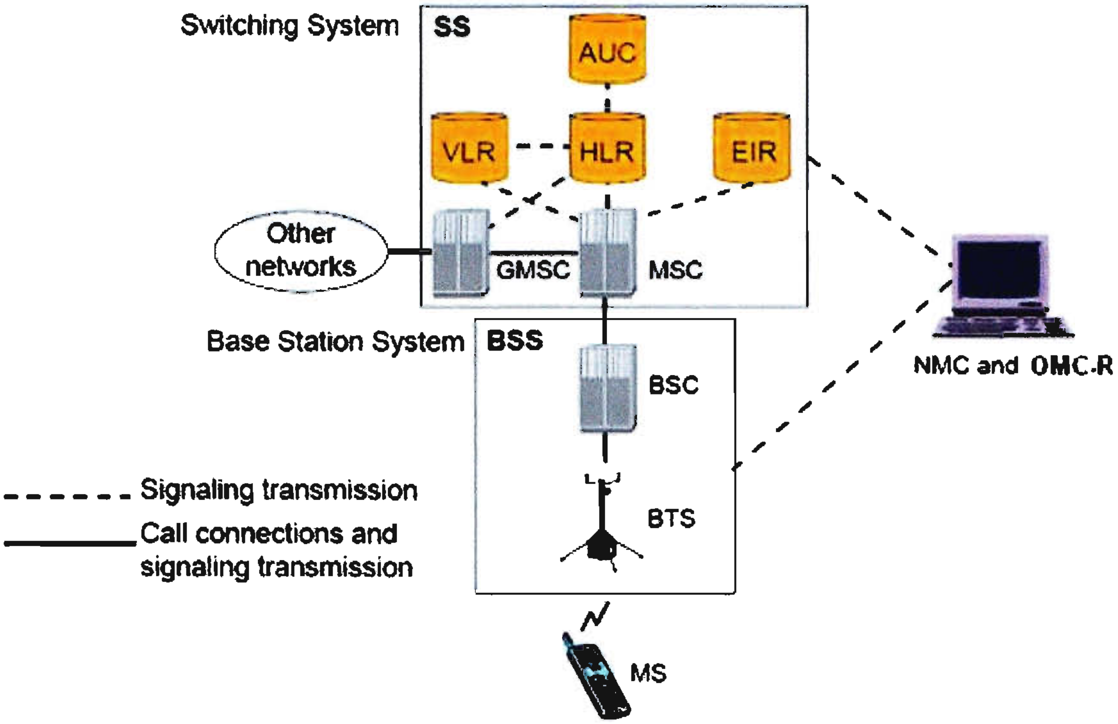


Figure: GSM Basic Architecture

GSM Band:

GSM-900, GSM-1800 and GSM-1900 are used in most parts of the world. GSM-1900 Band Uses only American Countries. GSM-900 and GSM-1800 use others Countries.

In our country, we use GSM-900(890–915 MHz for uplink and 935–960 MHz for downlink) and GSM-1800(1,710–1,785 MHz for uplink and 1,805–1,880 MHz for downlink).

In my Company Use Only GSM-1800 MHz .

Mobile Services Switching Center (MSC):

The primary node in a GSM network is the MSC. It is the node, which controls calls both to MS's and from MS's. The primary functions of an MSC include the following:

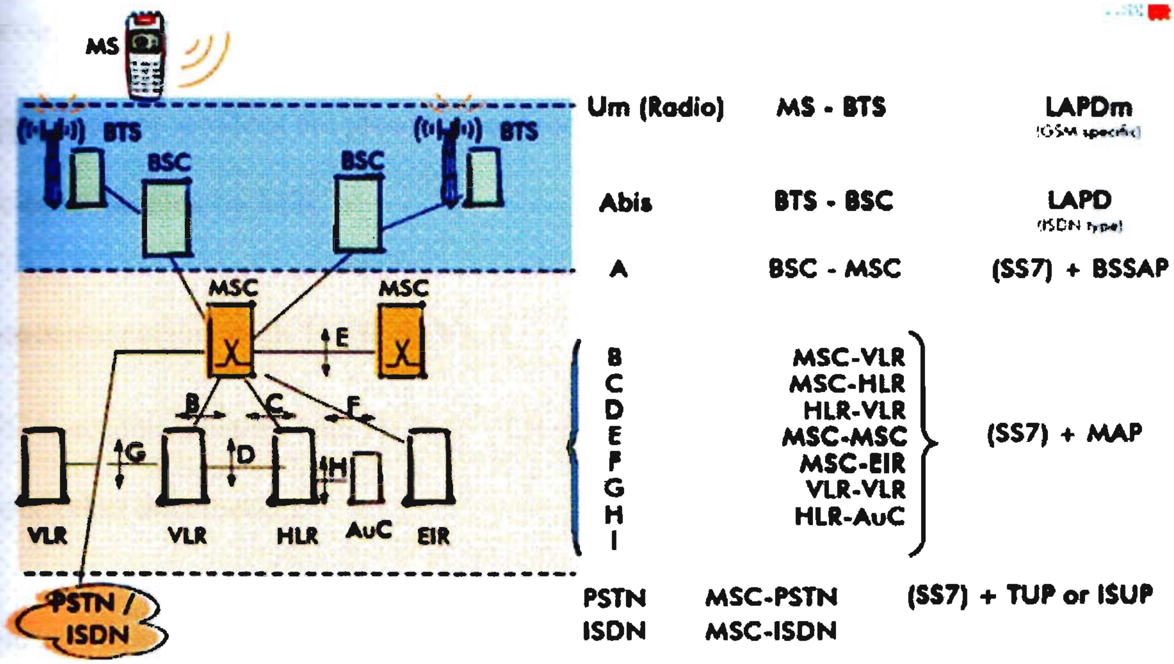


Figure: GSM Architecture with Protocol

Switching and call routing

MSC interact with other nodes to successfully establish a call. During a call it involves in handovers from one BSC to another and inters MSC handover.

Charging:

MSC contains functions for charging mobile calls and information about the particular charge rates to apply to a call at any given time or for a given destination. During a call it records this information (Call Data Record-CDR) and sends it to the billing center.

Service provisioning:

Supplementary services are provided and managed by a MSC. In addition, the SMS service is handled by MSC's

Communication with HLR & VLR

MSC is communicating with HLR & VLR when call setup and release and get subscription information.

Communication with other MSCs

MSC's communicate with each other during call setup or handovers between cells belonging to different MSC's.

Control of the connected BSCs

An MSC may communicate with its BSC's during; for example, call set-up and handovers between two BSC's.

Visitor Location Register (VLR):

The role of a VLR in a GSM network is to act as a temporary storage location for subscription information for MSs which are within a particular MSC service area. Thus, there is one VLR for each MSC service area. This means that the MSC does not have to contact the HLR every time the subscriber uses a service or changes its status.

VLR contains following data.

- Identity numbers for the subscriber
- Supplementary service information (e.g. whether the subscriber has call

forwarding on busy activated or not)

- Activity of MS (e.g. idle)
- Current LA of MS

Home Location Register (HLR):

The HLR is a centralized network database that stores and manages all mobile subscriptions belonging to a specific operator. It acts as a permanent store for a person's subscription information until that subscription is cancelled. The information stored includes:

- Subscriber identity (i.e. IMSI, MSISDN)
- Subscriber supplementary services
- Subscriber location information (i.e. MSC service area)
- Subscriber authentication information

Authentication Center (AUC):

The primary function of an AUC is to provide information, which is then used by an MSC/VLR to perform subscriber authentication and to, establish ciphering procedures on the radio link between the network and MS's. The information provided is called a triplet and consists of:

- A non predictable Random number (RAND)
- A Signed Response (SRES)
- A ciphering Key (Kc)

Equipment Identity Register (EIR):

The equipment identification procedure uses the identity of the equipment itself (IMEI) to ensure that the MS terminal equipment is valid.

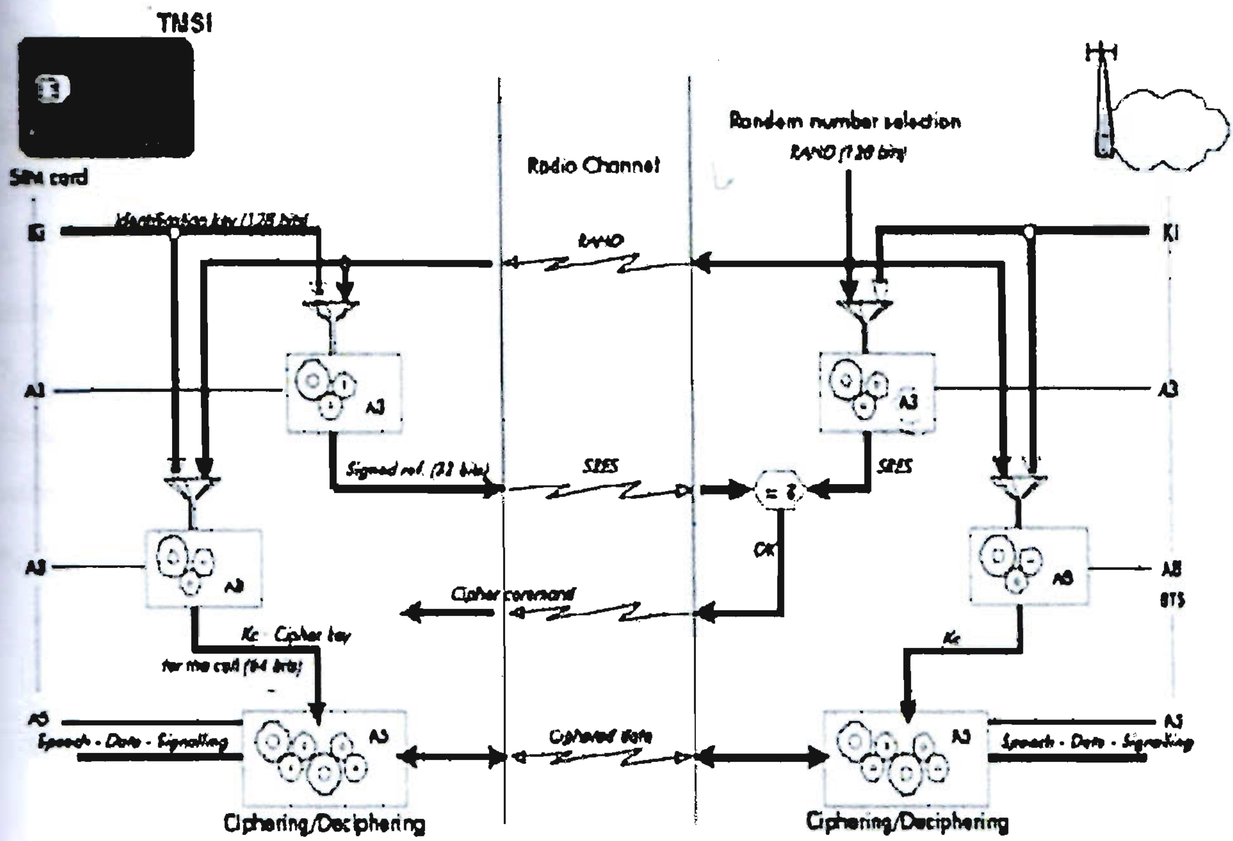


Figure: Subscriber Authentication Process

At subscription time, each subscriber is assigned a subscriber authentication Key (Ki). Ki is stored in the AUC (Authentication Center) along with the subscriber's IMSI (International Mobile Subscriber Identity). Both are used in the process of providing a triplet. The same Ki and IMSI are also stored in the SIM.

1. A non-predictable random number, RAND, is generated at the Authentication Center.

2. RAND and Ki are used to calculate Signed Response (SRES) and Kc, using two different algorithms, A3 and A8 respectively.
3. RAND, SRES and Kc are delivered together to the HLR as a triplet.
4. The MSC/VLR transmits the RAND to the MS.
5. The MS computes the signature SRES using RAND and the subscriber authentication key (Ki) through the A3 algorithm.
6. The MS computes the Kc by using Ki and RAND through A8 algorithm. Kc will thereafter be used for ciphering and deciphering in MS.
7. The signature SRES is sent back to MSC/VLR, which performs authentication, by checking whether, the SRES from the MS and the SRES from the AUC match. If so, the subscriber is permitted to use the network. If not, the subscriber is barred from network access.

CHAPTER 2

GSM NETWORK IDENTITIES

Network identities are numbers that a GSM network uses to locate a mobile subscriber when it is establishing a call to that subscriber. As the network relies on these identities to route calls to subscribers, it is important that each identity is unique and correct.

Mobile Station ISDN number (MSISDN)

The Mobile Station ISDN number (MSISDN) uniquely identifies a mobile telephone subscription in the PSTN numbering plan. This is the number dialed when calling a mobile subscriber.

MSISDN

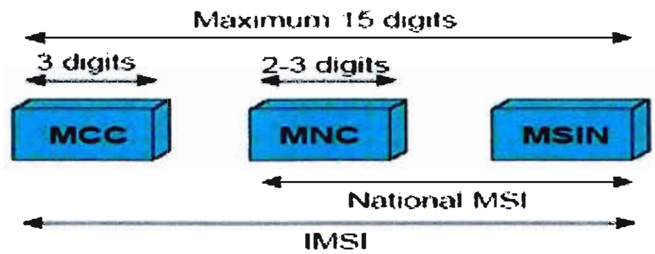
CC Country Code

NDC National Destination Code

SN Subscriber Number

International Mobile Subscriber Identity (IMSI)

The International Mobile Subscriber Identity (IMSI) is a unique identity allocated to each subscriber that facilitates correct subscriber identification over the radio path and through the network. It is used for all signaling in the PLMN.



IMSI

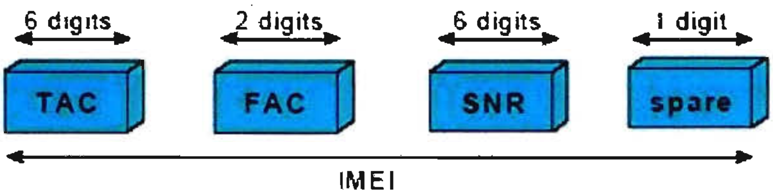
MCC	Mobile Country Code
MNC	Mobile Network Code
MSIN	Mobile Station Identification Number

Temporary Mobile Subscriber Identity (TMSI)

The Temporary Mobile Subscriber Identity (TMSI) is a temporary IMSI number made known to an MS at registration. It is used to protect the subscriber's identity on the air interface. The TMSI has local significance only (that is, within the MSC/VLR area) and is changed at time intervals or when certain events occur such as location updating

International Mobile Equipment Identity (IMEI)

The International Mobile Equipment Identity (IMEI) is used to uniquely identify MS equipment to the network. The IMEI is used for security procedures such as identifying stolen equipment and preventing unauthorized access to the network.



IMEI

TAC Type Approval Code, determined by a central GSM body

FAC Final Assembly Code, identifies the manufacturer

SNR Serial Number, an individual serial number of six digits uniquely identifies all equipment within each TAC and FAC

spare A spare digit for future use. When transmitted by the MS this digit should always be zero

Mobile Station Roaming Number (MSRN)

The Mobile Station Roaming Number (MSRN) is a temporary network identity which is assigned during the establishment of a call to a roaming subscriber.

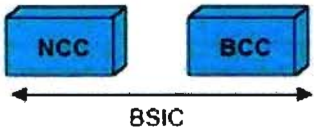
The Location Area Identity (LAI) is a temporary network identity, which is also required for routing. The two main purposes of the LAI are, paging, which is used to inform the MSC of the LA in which the MS is currently situated and location updating of mobile subscribers.

Cell Global Identity (CGI)

The Cell Global Identity (CGI) is used for identifying individual cells within a LA. Cell identification is achieved by adding a Cell Identity (CI) to the LAI components.

Base Station Identity Code (BSIC)

The Base Station Identity Code (BSIC) enables MS's to distinguish between different base stations sending on the same frequency.



BSIC

NCC Network Color Code (3 bits) identifies the PLMN. It does not uniquely identify the operator. NCC is primarily used to distinguish between operators on each side of a border

BCC Base Station Color Code (3 bits) identifies the Base Station to help distinguish between BTS using the same control frequencies

MOBILE ORIGINATING CALL

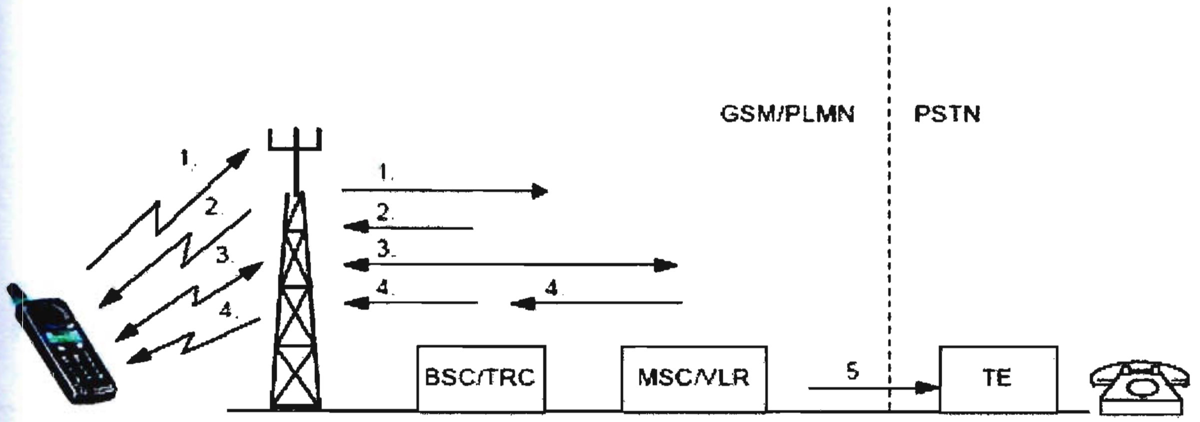


Figure: Mobile originating call

A call is originated from a MS as follows,

1. The MS uses RACH (Random Access Channel) to ask for a signaling channel.

2. The BSC/TRC allocates a signaling channel, using AGCH (Access Grant Channel).

3. The MS sends a call set-up request via SDCCH (Stand alone Dedicated Control Channel) to the MSC/VLR. Over SDCCH all signaling preceding a call takes place. This includes:

- Marking the MS as "active" in the VLR
- The authentication procedure
- Start ciphering
- Equipment identification
- Sending the B-subscriber's number to the network
- Checking if the subscriber has the service "Barring of outgoing calls" activated

4. The MSC/VLR instructs the BSC/TRC to allocate an idle TCH. The BTS and MS are told to tune to the TCH.

5. The MSC/VLR forwards the B–number to an exchange in the PSTN, which establishes a connection to the subscriber.

6. If the B-subscriber answers, the connection is established.

MOBILE INTELLIGENT NETWORK (MIN OR IN)

A Mobile Intelligent Network (MIN) is a telecommunications concept that meets the market demand for advanced services within the existing telephony network, from both the network operator's and service provider's perspective. The intelligence in the MIN is realized in computer software and data. The ultimate objective of MIN is to increase revenue for the network operator and the service provider.

IN Network Architecture

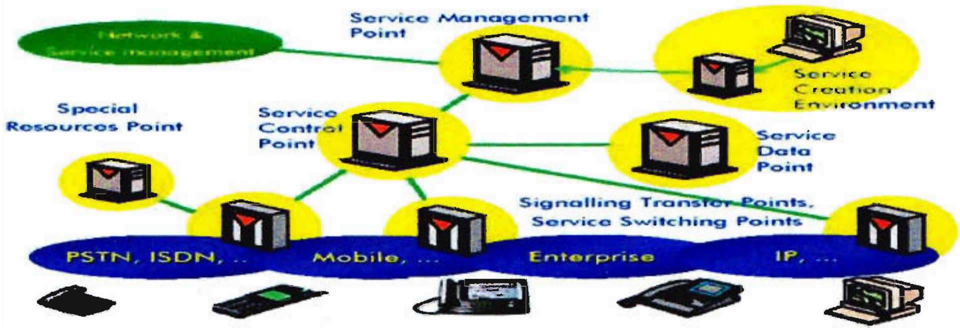


Figure: IN Network Architecture

- Advantages of MIN
  - Increased subscriber numbers due to more attractive services
  - Increased revenue due to use of services
  - Increased subscriber loyalty
  - Increased flexibility in deploying services in a network
  - Decreased development time for services
  - Reusability of service modules
- MIN services
  - Personal Number
  - Pre-Paid SIM Card
  - Cellular Virtual Private Network (CVPN)
  - Information and business

CHAPTER 3

Plesiochronous Digital Hierarchy (PDH)

There are two types of multiplexing hierarchies of Time Division Multiplexing (TDM), used in digital transmission. Traditionally, digital transmission systems and hierarchies have been based on multiplexing signals which are plesiochronous. To recover a 64kbps channel from a 140Mbps PDH signal it is necessary to demultiplex the signal all the way down to the 2 Mbps E1 level before the location of the 64 kbps channel can be identified. PDH requires multiplexing steps of 2-8, 8-34, 34-140 to add or demultiplexing steps of 140-34, 34-8, 8-2 to drop out an individual speech or data channel.

Plesiochronous Digital Hierarchy

Signal	Digital bit rate / (kb/s)	Channels
E0	64	1 E0
E1	2048	32 E0
E2	8448	4 E1
E3	34368	16 E1
E4	139264	64 E1

Synchronous Digital Hierarchy (SDH)

Synchronous Digital Hierarchy is a standard for telecommunications transport formulated by the International Telecommunication Union (ITU). The basic format of an SDH signal allows it to carry many different services in its Virtual Container (VC) because it is bandwidth-flexible. This capability allows for such things as the transmission of high speed packet switched services, ATM. However SDH still permits transport and networking at the 2Mbps, 34Mbps, and 140Mbps levels accommodating the existing PDH signals. In addition SDH supports the transport of signals based on the 1.544Mbps hierarchy used in America.

Synchronous Digital Hierarchy

Bit rate / (Mb/s)	Abbreviated	SDH	SDH Capacity
51.84	51 Mb/s	STM-0	21 E1
155.52	155 Mb/s	STM-1	63 E1
622.08	622 Mb/s	STM-4	4 E4
2488.32	2.4 Gb/s	STM-16	16 E4
9953.28	10 Gb/s	STM-64	64 E4
39813.12	40 Gb/s	STM-256	256 E4

SIGNALING SYSTEM NO.7 (SS7)

Signaling System No. 7 (SS7 or C7) is a global standard for telecommunication defined by the International Telecommunication Union (ITU) Telecommunication Standardization Sector (ITU-T). The standard defines the procedures and protocol by which network elements in the public switched telephone network (PSTN) exchange information over a digital signaling network to effect wireless (cellular) and wire line call setup, routing and control.

Each signaling point in the SS7 network is uniquely identified by a numeric point code. Point codes are carried in signaling messages exchanged between signaling points to identify the source and destination of each message. Each signaling point uses a routing table to select the appropriate signaling path for each message. There are three kinds of signaling points in the SS7 network.

SSP (Service Switching Point)

SSPs are switches that originate, terminate or tandem calls. An SSP sends signaling messages to other SSPs to setup, manage and release voice circuits required to complete a call.

STP (Signal Transfer Point)

Network traffic between signaling points may be routed via a packet switch called an STP. An STP routes each incoming message to an outgoing signaling link based on routing information contained in the SS7 message. Because it acts as a network hub, an STP provides improved utilization of the SS7 network by eliminating the need for direct links between signaling points.

SCP (Service Control Point)

A SCP is a centralized database that contains the information about how to route a call.

A figure of the SS7 Protocol Stack is shown below.

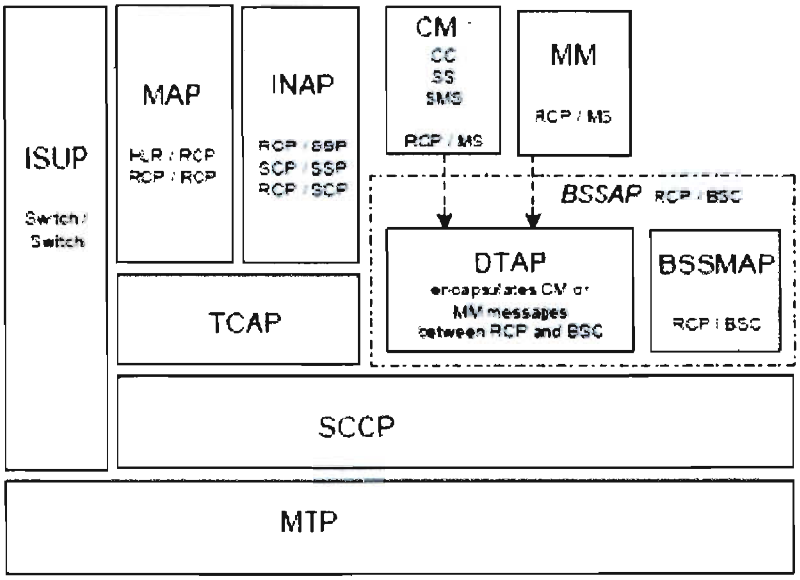


Figure: The SS7 Protocol Stack

Message Transfer Part (MTP)

The Message Transfer Part (MTP) is divided into three levels:

- MTP Level 1

The lowest level, MTP Level 1, is equivalent to the OSI Physical Layer. MTP Level 1 defines the physical, electrical and functional characteristics of the digital signaling link.

- MTP Level 2

MTP Level 2 ensures accurate end-to-end transmission of a message cross a signaling link. Level 2 implements flow control, message sequence validation and error checking. When an error occurs on a signaling link, the message (or set of messages) is retransmitted. MTP Level 2 is equivalent to the OSI Data Link Layer.

- MTP Level 3

MTP Level 3 provides message routing between signaling points in the SS7 network. MTP Level 3 reroutes traffic away from failed links and signaling points and controls traffic when congestion occurs. MTP Level 3 is equivalent to the OSI Network Layer.

Signaling Connection Control Part (SCCP)

SCCP provides connectionless and connection-oriented network services and global title translation (GTT) capabilities above MTP Level 3. A global title is an address that is translated by SCCP into a destination point code and subsystem number. A subsystem number uniquely identifies an application at the destination signaling point. SCCP is used as the transport layer for TCAP-based services.

Transaction Capabilities Applications Part (TCAP)

TCAP supports the exchange of non-circuit related data between applications across the SS7 network using the SCCP connectionless service. Queries and responses sent between SSPs and SCPs are carried in TCAP messages. For example, an SSP sends a TCAP query to determine the routing number associated with a dialed number and to check the personal identification number (PIN) of a calling card user. In mobile networks (IS-41 and GSM) TCAP carries Mobile Application Part (MAP) messages sent between mobile switches and databases to support user authentication, equipment identification and roaming.

ISDN User Part (ISUP)

The ISDN User Part (ISUP) defines the protocol used to set-up, manage and release trunk circuits that carry voice and data between terminating line exchanges (e.g., between a calling party and a called party). ISUP is used for both ISDN and non-ISDN calls. However, calls that originate and terminate at the same switch do not use ISUP signaling.

Software Details:

ZTE BSC (OMCR-2.8):

In Worldtel use ZTE ZXG-10 BSC. That why they use OMCR v-2.8. In 2nd generation technologies this version of software uses Solaris system and Oracle for databases. We use Solaris 9 sparc and oracle 8i enterprise edition.

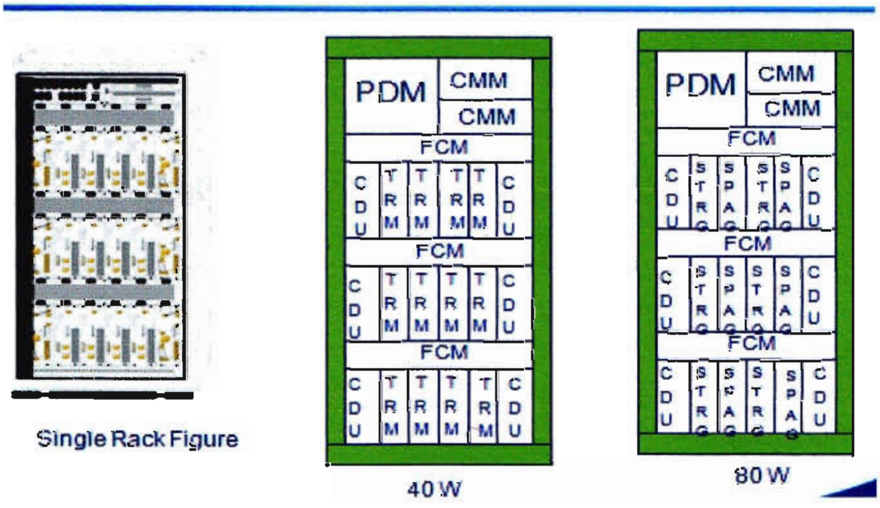


Figure: BTS STRUCTURE

ZTE MSC (V-3.06):

In Worldtel use ZTE ZXG-10 MSC. That why they use MSC v-3.06. In 2nd generation technologies this version of software uses Windows server 2000 system and MSSQL for databases.

Also IN network we use ZTE ZXA-10. In 2nd generation technologies this version of software uses Windows server 2000 system and MSSQL for databases.

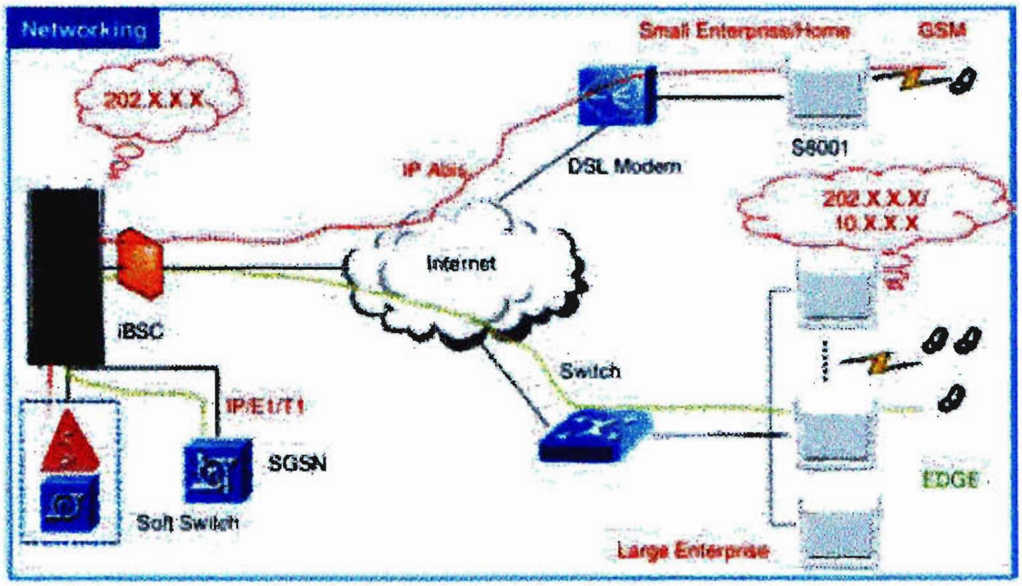


Figure: Typical Networking of ZXG10

CHAPTER 4

CONCLUSION

Conclusion

NOC Division of Worldtel is working all the time to ensure 24 X 7 systems and service surveillance. Itensures alarm surveillance of network elements and systems. Here, escalate, follow up and report alarms in 24 X 7 Roster until seizure has been done. In short the whole Worldtel network based on the NOC division. If monitoring is shut off for an hour then it will be a disaster.

As the NOC Division always stays on work pressure, they are trying their utmost to improve and develop their ways of communication as well as transactions with their employees, customers and clients.

According to my own experience the working environment of the organization is very inspiring. The senior who are working here are very helpful with the new employee's. From the beginning we got to know about our work from the bhaiya's in every position.

Worldtel Ltd is a renowned mobile company in Bangladesh. It covers the network all over the country. Many products and services of Worldtel are available in the market. Worldtel also doing social work through the project name 'ABAR HOBEI'.So I found myself really lucky and honoured to be a part of Worldtel family. While working here it seems like Worldtel is the part of my daily life.

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